196

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B. Tech.-III Semester (IT-Backlog)

COURSE CODE (CREDITS): 18B11MA313 (3) MAX MARKS: 35

COURSE NAME: PROBABILITY AND STATISTICS

COURSE INSTRUCTOR: SST MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

(c) Use of a scientific calculator is allowed.

Q. No.	Question	CO	Marks
Q1	An aircraft maintenance company bought equipment for detecting structural defects in aircrafts. Tests indicate that 95 % of the time the equipment detects defects when they actually exist, and 1 % of the time it gives a false alarm that indicates the presence of a structural defect when in fact there is none. If 3 % of the aircrafts actually have structural defects, what is the probability that an aircraft actually has a structural defect given that the equipment indicates that it has a structural defect?	1	5
Q2	The probability mass function of the number N of customers that arrive at a local library within a one-hour interval is defined by, $$p_N(n) = \begin{cases} \frac{5^n}{n!}e^{-5} & n = 0, 1, \dots \\ 0 & \text{otherwise} \end{cases}$$ What is the probability that at most two customers arrive at the library within one hour?	2	5
Q3	Calculate Karl Pearson's coefficient of correlation for the following data, where response y is the acid content of material produced by titration, whereas the regressor x is the organic acid content produced by extraction and weighing.	4	5
Q4	The grades of a class of 9 students on a midterm report (x) and on the final examination (y) are as follows:	4	5

x	109	48	138	164	28
y	70	37	82	88	43

x	77	50	71	72	81	94	96	99	67
y	82	66	78	34	47	85	99	99	68

Estimate the linear regression line.

Q5	Fit a straight line of the form $y = a + bx$, to the following data, using the method of least squares: x: 2, 7, 9, 1, 5, 12 y: 13, 24, 23, 14, 15, 21	4	5
Q6	A beverage company claims that the average sugar content in its soft drink bottles is 50 grams. A random sample of 10 bottles is tested, and the sugar contents (in grams) are found to be: 48, 52, 47, 49, 51, 46, 50, 53, 49, 48 At a 5% level of significance, test whether the company's claim is valid using a one-sample t-test.	5	5
Q7	A random sample of 90 adults is classified according to gender and the screentime during a week: Gender: Male / Female Over 25 hours: 15 / 29 Under 25 hours: 27 / 19 Use a 0.05 level of significance and test the hypothesis that the screentime is independent of whether the viewer is male or female.	5	5

Parts of Useful Statistical Tables:

Table A.5 (continued) Critical Values of the Chi-Squared Distribution

	α									
v	0.30	0.25	0.20	0.10	0.05	0.025	0.02	0.01	0.005	0.001
1	1.074	1.323	1.642	2.706	3.841	5.024	5.412	6.635	7.879	10.827
2	2.408	2.773	3.219	4.605	5.991	7.378	7.824	9.210	10.597	13.815
3	3.665	4.108	4.642	6.251	7.815	9.348	9.837	11.345	12.838	16.266

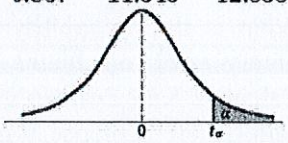

Table A.4 Critical Values of the t-Distribution

	α						
v	0.40	0.30	0.20	0.15	0.10	0.05	0.025
1	0.325	0.727	1.376	1.963	3.078	6.314	12.706
2	0.289	0.617	1.061	1.386	1.886	2.920	4.303
3	0.277	0.584	0.978	1.250	1.638	2.353	3.182
4	0.271	0.569	0.941	1.190	1.533	2.132	2.776
5	0.267	0.559	0.920	1.156	1.476	2.015	2.571
6	0.265	0.553	0.906	1.134	1.440	1.943	2.447
7	0.263	0.549	0.896	1.119	1.415	1.895	2.365
8	0.262	0.546	0.889	1.108	1.397	1.860	2.306
9	0.261	0.543	0.883	1.100	1.383	1.833	2.262
10	0.260	0.542	0.879	1.093	1.372	1.812	2.228